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JES Focus Issue on Processes at the Semiconductor-Solution Interface

Preface—Focus Issue on Processes at the Semiconductor-Solution Interface

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This focus issue addresses some of the cutting edge research themes in many processes that occur at the interface between a semiconductor and a solution. This interface, a pH and redox potential-controlled liquid analog to the metal-semiconductor interface, is where semiconductor electrochemistry occurs. With the advent of alternative approaches to lower cost and more efficient hydrogen production, to the energetics of the electrolyte-material interface for batteries, the physics and electrochemistry of solar photovoltaics, and transistor-based technologies that monitor liquid-based biological interactions and so much more, this interface remains central to the underlying mechanisms for so many multidisciplinary topics. Energy storage and conversion, materials design and characterization, environmental science and technology, and much more, rely on this critical interface as part of the scientific search for a sustainable energy future.

Controlling the processes that occur at the semiconductor-solution interface and exploiting mechanisms and properties for a wide variety of electrochemical and photoelectrochemical technologies are major research drivers for materials research, electrochemistry, electronics, and sustainable energy research. The pursuit of a well-defined and controllable interface with a liquid is fundamental to batteries, to hydrogen production, to advanced materials and devices, and to biological processes. Individual advances in these sub-fields can inspire developments in semiconductor (photo)electrochemistry and the many processes at the interface between materials and liquids or electrolytes, that underpin their very operation and understanding, but may also uncover the next major advance that could improve materials, systems development, deployment and scalability to help drive an energy efficient and greener society.

This focus issue follows from the symposium series on *Processes at the Semiconductor Solution Interface* held every two years at the ECS spring meetings, which provides a forum for high quality and cutting edge dissemination of research spanning the fundamental science and technological application of etching, oxidation, passivation, film growth, electrochemical and photoelectrochemical processes, electrochemical surface science, electroluminescence, photoluminescence, surface texturing, compound semiconductor electrodeposition, for photovoltaics, energy conversion, in situ and operando techniques for semiconductor-solution interface process examination, and related topics.

The issue also contains advances in silicon and III-V semiconductor etching, the material-solution interface stability for high voltage batteries, photoelectrochemical investigations of semiconductors and oxides for hydrogen and oxygen evolution, and methods for determining the nature of water interactions at photoanode surfaces. This focus issue also details advancements made in the electrochemical growth and electrodeposition of II-VI and related semiconductor materials. The issue comprehensively covers a range of important topics in processes at, and processing of, the semiconductor-solution interface.

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